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COMPLEMENTARITY OF SEASONAL PATTERNS
OF MILK DELIVERIES BY INDIVIDUAL FARMERS

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FARMER COOPERATIVE SERVICE
United States Department of Agriculture
Washington 25, D.C.

by
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FORWORD

The ideas in this report were developed in the course of studies of the problems of seasonal milk deliveries. The discussion is somewhat contemplative and conclusions and suggestions are tentative. This report was prepared primarily for economists and farm management specialists engaged in research and extension programs.

United States Department of Agriculture
FARMER COOPERATIVE SERVICE
Washington, D. C.

Joseph G. Knapp, Administrator

CONTENTS

	<u>Page</u>
Individual seasonal patterns are partially complementary.....	2
Seasonal patterns of many producers are erratic.....	2
Applications to seasonal pricing.....	4
Base-excess pricing plans.....	4
Plans using seasonal variation of prices.....	7
Applications in educational programs directed to producers.....	7
Research and educational needs indicated by tendency toward erratic variation.....	9
Summary.....	10

This was the outgrowth of a study conducted under authority of the Agricultural Marketing Act of 1946 (RMA), Title II).

The Farmer Cooperative Service conducts research studies and service activities of assistance to farmers in connection with cooperatives engaged in marketing farm products, purchasing farm supplies, and supplying business services. The work of the Service relates to problems of management, organization, policies, financing, merchandising, product quality, costs, efficiency, and membership.

The Service publishes the results of such studies; confers and advises with officials of farmer cooperatives; and works with educational agencies, cooperatives, and others in the dissemination of information relating to cooperative principles and practices.

Complementarity of Seasonal Patterns
of Milk Deliveries by Individual Farmers

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Problems associated with seasonal variations in fluid milk production and deliveries to plants have been the subject of numerous inquiries by agricultural economists. The usual seasonal variation of milk deliveries to a market causes difficult marketing problems. Fluid milk "requirements" vary little from season to season, while farmers in most markets deliver substantially more milk during the spring flush period than in the usual fall "slump." Both the timing and amplitude of these seasonal changes vary from market to market.

Farm management specialists have made numerous studies of problems that relate to seasonality. Marketing specialists have analyzed seasonal patterns in various markets and changes therein, and have compared patterns of seasonal variation among marketing areas. They have made numerous analyses of base-excess and fall premium pricing plans.

The marketing analyses have emphasized the needs of the market. They have relied principally on aggregative data -- total and average deliveries and "typical" seasonal patterns. There appears to have resulted from this approach too little consideration of problems of the individual producer.

The salient feature of the problem from the herd management standpoint is that combinations of resources differ from farm to farm. The optimum seasonal pattern of deliveries on one farm may be quite different from that on a neighboring farm. The need, therefore, is to coordinate the marketing and the production economics approaches. The following discussion attempts to bridge the gap in certain respects between ideas arising from viewing aggregative data and market needs on the one hand and ideas arising from viewing management problems of the farmer on the other.

This report develops two characteristics of the patterns of deliveries by individual producers and indicates some implications that appear to arise therefrom. One characteristic is that individual seasonal patterns are partially complementary. The other is that seasonal patterns of many producers are erratic. The features of the data discussed here are not new discoveries; they have been noted in several published reports. But separate discussion of these characteristics may lead to more general recognition of their implications.

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Individual Seasonal Patterns Are Partially Complementary

The seasonal pattern of the milk supply in a market is the composite of seasonal patterns of deliveries by many producers. The producers who deliver milk to a market each have distinct and in some cases completely opposite seasonal patterns of deliveries. This can be illustrated by data on deliveries by members of Connecticut Milk Producers Association and members of Wichita Milk Producers Association (Table 1). One Connecticut producer delivered only 49 percent as much milk in May and June as in October and November. At the other extreme, another of the 100 Connecticut producers delivered 241 percent as much milk in the spring as in the fall. Comparable extremes among the 100 Wichita producers were spring-fall ratios of 40 and 307 percent. These extremes would be even greater if the comparison were between individual months, rather than between pairs of months.

It further illustrates the wide variations in individual seasonal patterns to compare them to the pattern for the entire market. Average daily deliveries by Connecticut producers in May and June 1954, were 107.7 percent of average daily deliveries in October and November. Yet 9 of the sample of 100 Connecticut producers included in Table 1 had a spring-fall ratio of deliveries below 80 percent. Eighteen others had spring-fall ratios of 140 percent or more.

Thus, deliveries by producers with comparatively high fall deliveries modify and partly offset the effect on the market of producers with high spring peaks of deliveries. Conceptually we can expect averages such as marketwide totals to have less extreme fluctuations than most individual observations because individual peaks and lows usually do not coincide. The clarity of this idea plus the data presented adequately support the idea that seasonal patterns of individual producers partially complement each other.

Seasonal Patterns of Many Producers Are Erratic

The seasonal patterns of deliveries by an individual producer one year may become quite a different seasonal pattern the next year or within a few years.

Merton Parsons, et. al., ^{1/} encountered this situation in dividing 328 producers in the Boston milkshed into groups by their seasonal patterns of deliveries. It was discovered that only 19 percent of the producers fell within the same group in each of three years, 1945-47. When the test of consistency was applied to five and seven consecutive years, only 5 and 2 percent, respectively, of the producers met the test.

^{1/} Parsons, Merton S., et. al., The Seasonal Adjustment of Milk Production in the Boston Milkshed. Bureau of Agr. Economics, U.S.D.A. (Mimeo.), 1950. P. 6. The authors finally grouped the producers by their "usual" seasonal pattern for a period of years.

Table 1. - Ratios of spring to fall deliveries of milk, 100 members of Connecticut Milk Producers Association and 100 members of Wichita Milk Producers Association, 1954

Spring deliveries divided by fall deliveries 1/ (Percent)	Number of producers	
	Connecticut	Wichita
40 - 59	1	6
60 - 79	8	18
80 - 99	20	23
100 - 119	29	23
120 - 139	24	10
140 - 159	7	8
160 - 179	6	3
180 - 199	2	4
200 - 219	2	3
220 and over	1	2
	—	—
Total	100	100

1/ Connecticut: May plus June divided by October plus November.
Wichita: April plus May divided by October plus November.

Source: Based on computations from records of Connecticut Milk Producers Association and Wichita Federal Milk Market Administrator.

Data relating to 20 randomly selected producers in other markets illustrate the idea of year-to-year variation of seasonal patterns (Table 2). Monthly ratios to trend of deliveries were computed for each producer by dividing average daily deliveries for each month by a centered 12-month moving average. Then the ratio to trend for each month was subtracted from the corresponding figure one year earlier. Signs were disregarded. This does not provide an elegant measure of constancy or variability of seasonal pattern but nevertheless provides an indication.

Data discussed may not be fully representative of all producers in these or other markets or of performance during other periods. There seems little reason, however, to question that: (1) Milk deliveries to a market are made up of various divergent seasonal patterns which tend to offset each other, and (2) seasonal patterns of many producers vary substantially from year to year.

Applications to Seasonal Pricing

Seasonal pricing plans for milk should be developed with the characteristics of seasonal patterns of deliveries by individual producers in mind as well as the needs of the market. The different seasonal pricing plans have different characteristics and implications with respect to the ideas of complementarity and tendency toward erratic behavior. These latter, of course, are not the only considerations in choosing and developing a seasonal price plan.

Base-Excess Pricing Plans

Base-excess pricing plans have the implication that the desirable situation is for all individual producers to maintain seasonally even (level) deliveries, without substantial variations from year to year.

Base-excess pricing provisions, in themselves, and as usually applied, establish no incentive for a producer to deliver more milk in the fall than during other seasons. Optimum pricing results are obtained through uniform deliveries in all months; there is no need to go further. This feature tends to deprive the producer of an incentive for the service of offsetting (complementing) the seasonal pattern of producers with a spring peak.

Base-excess plans containing penalty provisions for not filling "quotas" doubly contain the above implications. Penalty provisions were established in 1947 by the Mid-South Milk Producers Association at Memphis, Tenn. The association charged dealers the same price for imported milk as that locally produced and prorated the losses on imported milk among those producers who failed to deliver their full quotas, thus making imports necessary. When Class I needs of the market exceeded both milk deliveries and the sum of all quotas, those quotas were increased on a proportionate basis so Class I needs would be covered by quota.

Table 2. - Averages of year-to-year variations in corresponding monthly ratios to 12-month centered moving averages of milk deliveries for 20 individual producers, 1949-54 1/

Array of 2 groups of 10 producers each 2/	
Group I	:
7.2	9.6
7.2	10.4
8.4	11.1
8.5	12.5
8.7	12.9
8.9	13.0
9.3	18.4
12.1	21.2
12.9	21.5
20.5	22.4

1/ Five years of data provided 48 comparisons between corresponding months. Figure for each producer is average of these 48 monthly comparisons. See text for other details of computation.

2/ Producers in Group I shipped to one market and producers in Group II shipped to another.

Source: Based on computations from records of Connecticut Milk Producers Association and Wichita Federal Milk Market Administrator.

assignments. ^{2/} The penalty provisions and the quota assignments were established to restore an incentive for dairymen to deliver an even flow of milk, after ordinary base-excess pricing provisions became ineffective because fluid requirements exceeded producer deliveries in many months.

A base-excess plan with penalty provisions for under-quota deliveries placed each individual producer under pressure from two sides to maintain an even flow of milk deliveries. He was "penalized" if he delivered more than his base during base operating months, ^{3/} since the price received for excess milk was lower than that for base milk. And he was penalized for high deliveries during the base forming period, if he failed to maintain this level of deliveries in the succeeding base operating period, and total deliveries by producers were less than requirements for Class I use.

There were pressing reasons for establishing the quota provisions at Memphis. Nevertheless, considered as a seasonal pricing plan, these provisions made it possible for a producer to be penalized (on an annual basis) although his deliveries were greatest during the fall period when total milk deliveries to the market were shortest. A thorough analysis of the operation of these quota provisions would reveal how frequently the plan had this result.

Bases established by deliveries during fall months of two or three successive previous years would assist base-excess plans in operating consistently with the year-to-year variation in seasonal patterns of individual producers.

The base for each producer in the base operating period might be established by his deliveries during specified months of two or three years, instead of one previous year. Thus, a producer would be less severely penalized in any one year as a result of low deliveries during one base forming period. Producers with erratic variation of seasonal patterns might consider the effect of such provisions more equitable than the effect of entirely new bases established each year.

Bases established by the record of two or three years would be subject to several limitations. First, the possible advantage appears to be largely a matter of averaging. These provisions would not result in a

2/ Hirsch, Hans G. and Hedges, Irwin R., An Analysis of the Base-Quota Plan in the Memphis Milkshed. Farm Credit Adm. Misc. Report 131 (processed), March 1949, Pp. 17-21.

3/ The base operating period is the months during which the base and excess prices are used in computing returns to individual producers.

substantial increase in the total gross returns over a period of years to a producer with erratic variations in his seasonal pattern. Second, the provisions described would move in the direction of the rigidities of closed-base plans. The discouragement of entry by new producers resulting from these provisions would tend to create a monopolistic situation for entrenched producers.

There have been some attempts to modify base-excess plans in view of year-to-year variation of fall deliveries. For example, provisions of the base-excess plan at Detroit moderate the cost to the producer of low production during a single base forming period. Base is established in relation to the base for the previous year, as well as deliveries during the regular base-forming period, if a producer's average deliveries during the specified fall period are less than 90 percent of his former base. New base becomes old base minus (90 percent of old base minus average daily deliveries during regular base forming period).

Provision may be made for adjustment of bases of individual producers in hardship cases. Base adjustment committees were a common feature of these plans in the 1930's. The decisions of these committees aroused much criticism and available information indicates that provisions for adjustment of bases have been much less common since World War II.

Plans Using Seasonal Variation of Prices

Fall premium pricing plans, or seasonal variation of Class I price differentials, give greater recognition than base-excess plans to the producer who delivers more milk in the fall than during other months.

These seasonal pricing arrangements provide incentives to producers for delivering a greater proportion of milk in the fall by providing substantially higher blend prices in certain months than in other specified spring months. The effect of these pricing provisions on producers thus is in proportion to the ratio of their deliveries during the specified fall and spring months. It has been contended by several observers, for example, that an advantage of the fall premium plan is in providing a greater reward for a fall peak of deliveries than for a substantially level seasonal pattern.

Applications in Educational Programs Directed to Producers

Education of producers about different aspects of the seasonal problem is a desirable companion to the establishment of a systematic seasonal

pricing plan. This appraisal has been expressed in passing by several analysts of seasonal pricing in reports of their studies. 4/

The production economics and marketing problems can be tied together in informational work. The farmer's most immediate concern is with his production problems. He no doubt recognizes that he is producing for a market with specific seasonal requirements, but this understanding may not be vivid and clear at times. The farmer's basic educational requirement regarding seasonality is to have the market needs and the consequent price conditions repeated, clarified, and given specific explanation. It may be explained that seasonal pricing provisions were designed to somewhat offset the herd management obstacles encountered in increasing fall production and thereby to bring the aggregate pattern of production in closer adjustment with fluid requirements. Dairy farmers would be well on the way to understanding the seasonal problem if they knew and accepted this viewpoint.

Educational material should be consistent with both production economics and marketing aspects of the seasonal problem. For example, persons who inform farmers about seasonality should recognize in their statements that different individuals will adjust their seasonal patterns to different extents in response to given price conditions.

What implications, then, have the characteristics of partial complementarity and the tendency toward erratic variations of individual patterns for producer education about seasonality? Broadly, these characteristics suggest that dairymen should be asked for "a larger proportion of deliveries in the fall," or "more fall deliveries," rather than for "even deliveries."

Each producer should be encouraged to work toward the seasonal pattern that will yield him the greatest net returns. 5/ The tendency of the different resulting individual patterns to offset each other should be relied upon to satisfactorily conform total supply to demand. Greater income incentives for fall deliveries may be established if the adjustment after a time is not satisfactory.

Responsible marketing personnel also will give farmers herd management tips on establishing a seasonal pattern with a greater proportion of fall deliveries. Within the individualistic approach advanced here,

4/ A study of educational programs about seasonality conducted by selected cooperatives was undertaken by Farmer Cooperative Service, U. S. Dept. of Agr. Stanley F. Krause, Meeting Seasonal Problem of Dairy Cooperatives through Education. FCS Bulletin 9, Washington, 1956.

5/ Many producers may, of course, not know their optimum seasonal pattern.

each producer would be given such management tips, encouraged to examine his own probable costs of alternative seasonal patterns, and encouraged to select his optimum pattern.

Encouragement of "even deliveries" on the other hand, appears to establish an artificial and rigid standard for each producer. The idea of encouraging "even deliveries" by each producer is superficial and unrealistic from the production economics standpoint in that conformance to this standard would not yield greatest net returns to each producer. Therefore, marketing officials and economists working with marketing problems no doubt could obtain more enthusiastic interest of farm management specialists in the seasonal problem and more cf their assistance if the educational entreaties were put on a more logical basis.

The educational approach of encouraging an increased proportion of deliveries in the fall also would give recognition to the year-to-year variations in the seasonal patterns of producers. Establishment of "even deliveries" by each producer as a standard somewhat implies failure by the producer each time he does not conform to that standard. The danger of creating this reaction by producers seems undesirable in view of the analysis of delivery patterns early in this paper.

On the other hand it may be acceptable to encourage "even deliveries" although this standard for each producer involves some elements of logical inconsistency. Psychological advantages of establishing a definite standard for each producer may offset the limitations of this approach. For example, the plea for "even deliveries" may permit marketing and educational personnel to try to motivate farmers by asking them to "help the market." In this connection, the strength of the pleas for "even deliveries" appears to lie in impressing the individual producer with his direct relationship to the market as a whole.

The goal of "even deliveries" by each producer may also be easier for dairymen to grasp than the reasons for asking producers to deliver a larger proportion of their milk in the fall. The basis and logic of simply asking producers for more of their milk in the fall, which we have argued, requires a more sophisticated line of economic reasoning. Finally, the relative effectiveness of different educational approaches is unknown and must be considered. The approach that seems logical to an economist may have to be rejected if it is ineffective.

Research and Educational Needs Indicated
by Tendency Toward Erratic Variation

Net returns of farmers probably would be increased by actions to stabilize somewhat their seasonal patterns of deliveries. Additional research effort might be devoted to discovering efficient ways to reduce year-to-year variation in patterns of individual and total deliveries. Dissemination of findings would require additional educational work of a technical nature.

Research and educational material should emphasize forage programs, or summer feeding programs, rather than the pasture improvement phase alone.

Excessive dependence on native pastures frequently results in severe seasonal slumps of total deliveries to a market. Research might point the way to improved forage programs which would provide a feed supply less vulnerable to unfavorable growing conditions. A further requirement is to keep farmers informed of present knowledge and new information about forage practices.

It is the view of farm management specialists that farmers could make many profitable changes in their forage programs. Some of these changes no doubt also would result in more nearly even deliveries, and would reduce uncertainty in a market about the level of milk deliveries in late summer and early fall months.

Continued educational effort is justified to assist farmers in controlling breeding time. Applied research under farm conditions would assist in directing this educational effort.

Many farmers attempt to have a large proportion of fall freshening cows or an even pattern of freshening, but fail to establish the intended seasonal pattern. Other dairymen do not attempt to control breeding dates.

At the very least, many farmers still feel they have greater difficulty in breeding cows for fall freshening than for spring freshening. This view was held by 76 of 197 farmers interviewed in 1954-55. 6/

Failure to control the breeding pattern may result in a tendency toward greater spring deliveries of milk than otherwise would be the case. Failure to control the breeding pattern also contributes to year-to-year variations in an individual farmer's seasonal pattern of deliveries. That is, the farmer experiences greater success in establishing the desired pattern in some years than others. This type of failure may result in losses to a dairyman, through an unplanned loss of production which may occur when he intends a cow to freshen in one month but she does not freshen until two, three, or more months later.

Summary

Analyses of marketing aspects of problems associated with seasonal variations of milk deliveries have relied largely on aggregative data.

6/ Data obtained by Farmer Cooperative Service, U.S. Dept. of Agr. from 100 members of Wichita Milk Producers Association and 97 members of Connecticut Milk Producers Association. Thirty-one WMPA members and 45 CMPA members held this view.

Analysts may not have given adequate attention to characteristics of seasonal patterns of individual producers. Partial complementarity of individual patterns and tendency of seasonal patterns of many producers to vary from year-to-year are discussed in this report. Some implications of these characteristics are proposed for further consideration. These relate to seasonal pricing provisions, education of producers about seasonality, and research needs.

Market or other aggregative patterns of receipts are made up of a variety of individual patterns. These various patterns partially offset each other, blending together into an aggregate pattern with far less amplitude than most of its components.

The seasonal distribution of the annual quantity of milk delivered by many individual producers shows erratic changes over a period of years. A producer may have one seasonal pattern one year and an entirely different pattern the next year or a few years later.

Certain seasonal pricing provisions may be more consistent with these characteristics of individual patterns of deliveries than are other provisions. Generally, fall premium milk pricing plans appear to have advantages over base-excess plans from this standpoint.

With respect to educating producers about the seasonal problem, complementarity and tendency toward year-to-year variation of individual patterns suggests a plea for "a larger proportion of deliveries in the fall." A plea for "even deliveries" implies that every producer should establish the same pattern.

Additional research effort needs to be devoted to discovering efficient ways to reduce year-to-year variations. Dissemination of present knowledge and future findings in this area requires additional educational effort of a technical nature.

Additional research also is needed to resolve satisfactorily the issues of pricing and educational actions raised in this report. Observations here have been of a tentative character. A team approach, involving the fields of marketing, production economics, and psychology would be appropriate. On this point, the reasoning in this report coordinates the marketing and production economics approaches to the seasonal problem in market milk. This reasoning may facilitate joint work of marketing men and farm management specialists on the seasonal problem.

The content of this report also applies to other commodities whose marketing involves a seasonal problem. Certainly the ideas of complementarity and tendency toward erratic year-to-year variations apply to eggs and poultry.

